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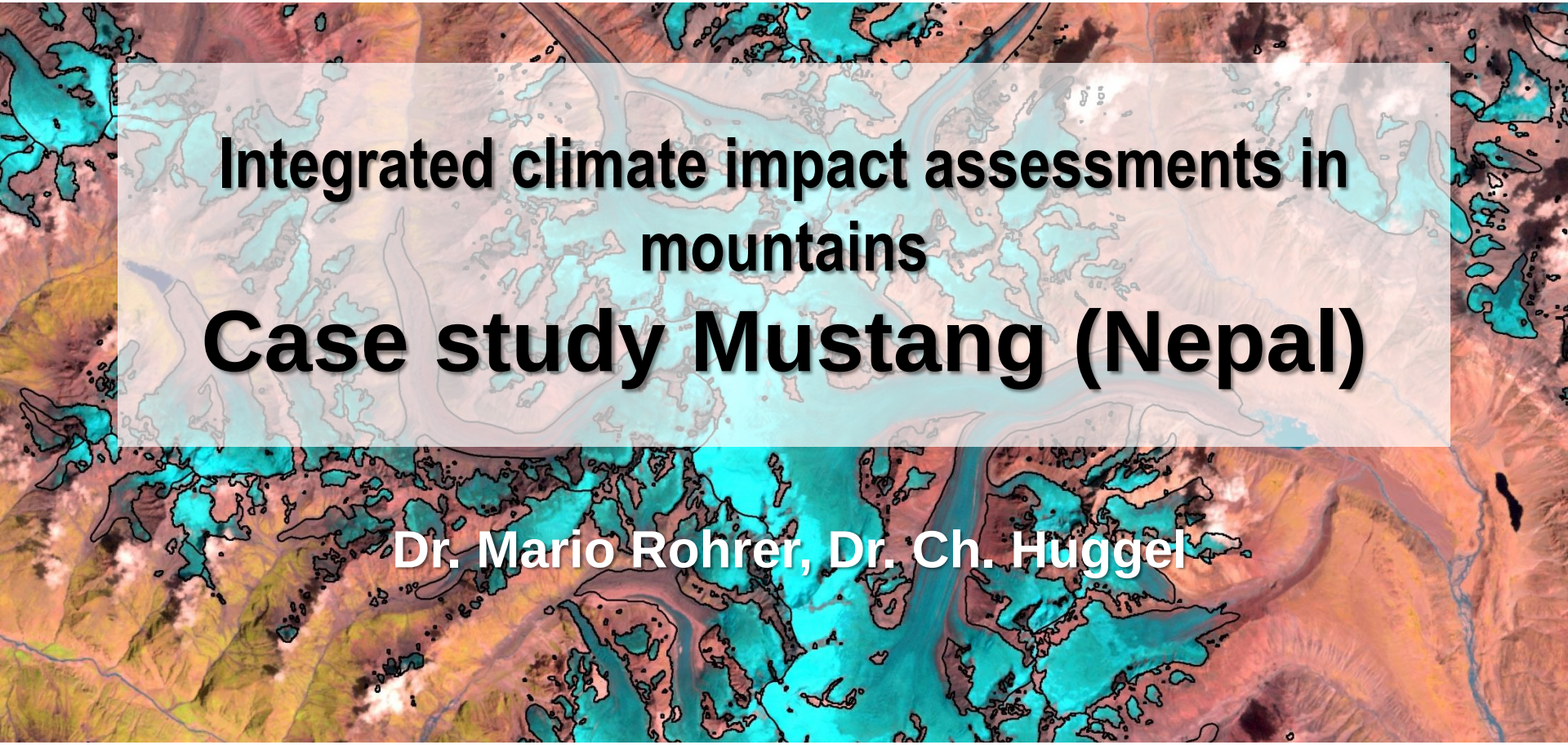

Integrated climate impact assessments in mountains

Case study Mustang (Nepal)

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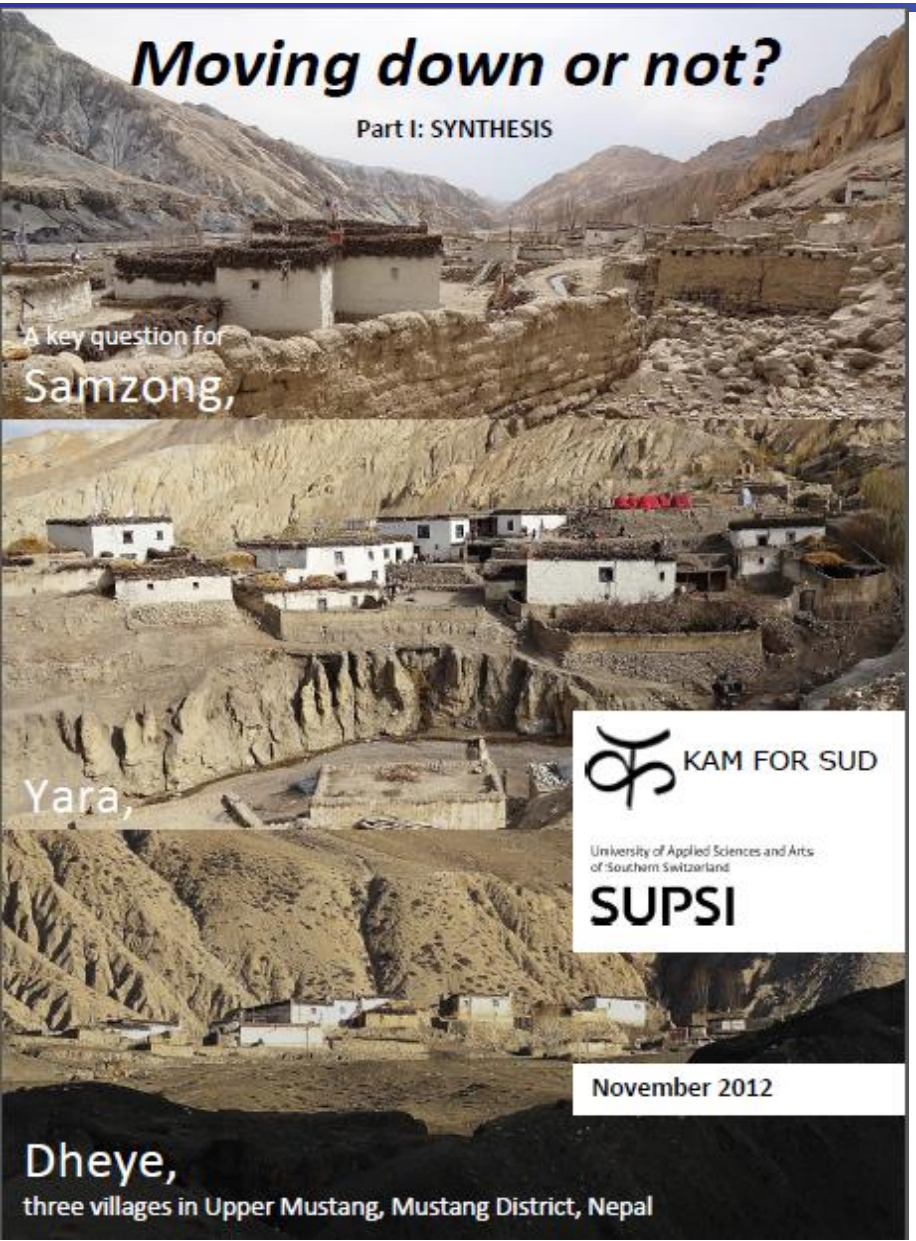
IHCAP – Indian Himalayas Climate Change Adaptation Programme
Capacity building programme “Cryosphere” Level-2 (February 2015)

Contents

Project goals



- The main goal of the project was to assess the most appropriate response for the three villages ***Samzong***, ***Yara*** and ***Dheye*** (Upper Mustang) to face current and future ***challenges*** in terms of ***water availability*** as well as ***natural risks***, which are at least partly ***driven by climate change***

Ultimate question:

Is it appropriate and/or necessary to resettle the whole communities

?

Collaboration

This study was undertaken by:

- **Kam For Sud (KFS)**
  Swiss NGO working for a sustainable development in Nepal since 1998,
  www.kamforsud.org
- **University of Applied Sciences of Southern Switzerland (SUPSI)**
  www.supsi.ch
- **Lo Mustang Foundation (LMF)**
  Nepali NPO, formed and directed by Lama Ngawang Kunga Bista, dedicated to developing the Upper Mustang region in the fields of education, health, environment and tourism,
  www.lo-mustanglmf.org
- **Meteodat GmbH**
  www. meteodat.ch

Overview

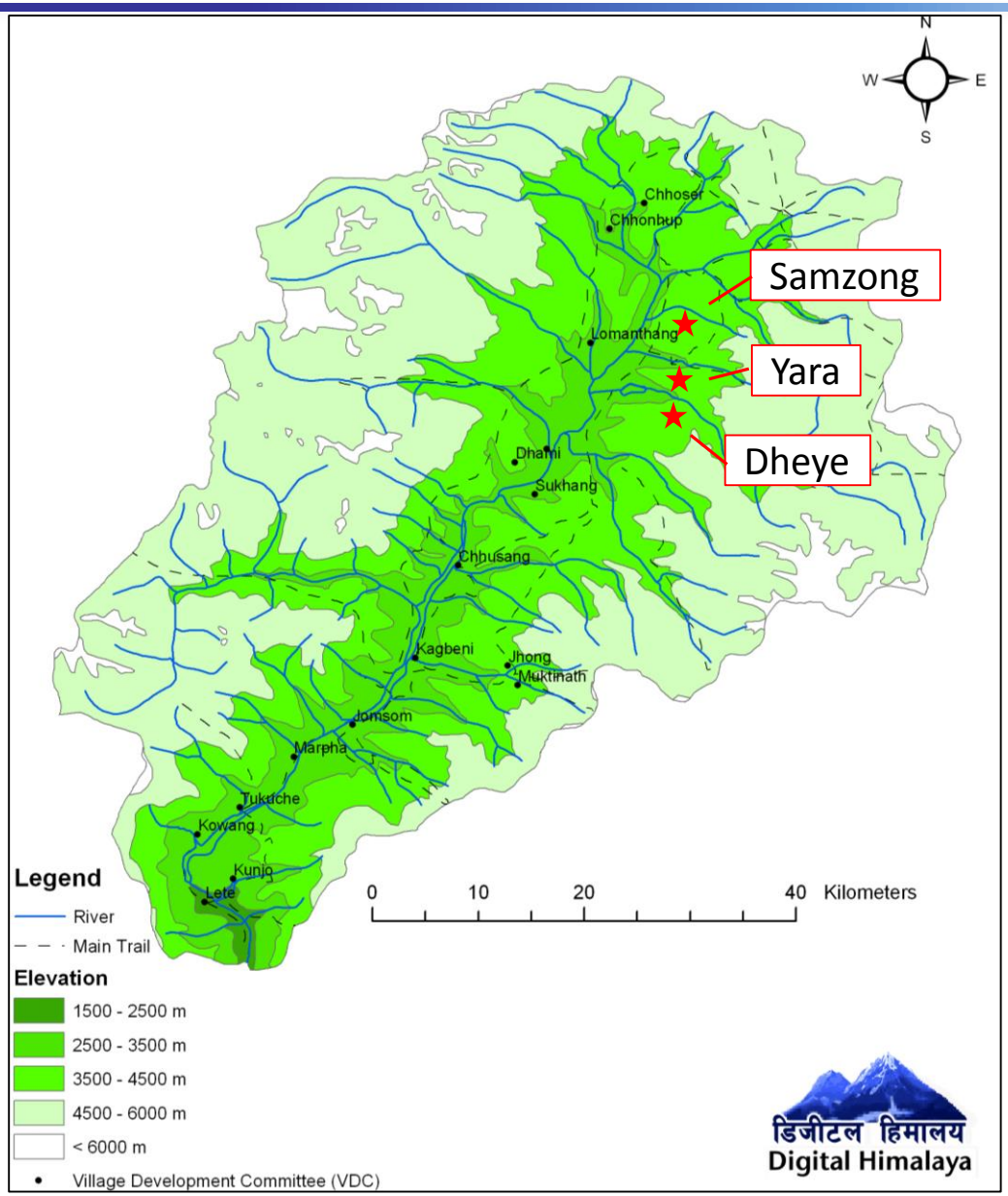
Location of Mustang District

- Upper Mustang (from Tibetan Mun Tan, "the fertile plain") is the former Kingdom of Lo.
- Today it is part of Nepal's District Mustang – one of the 75 districts of Nepal

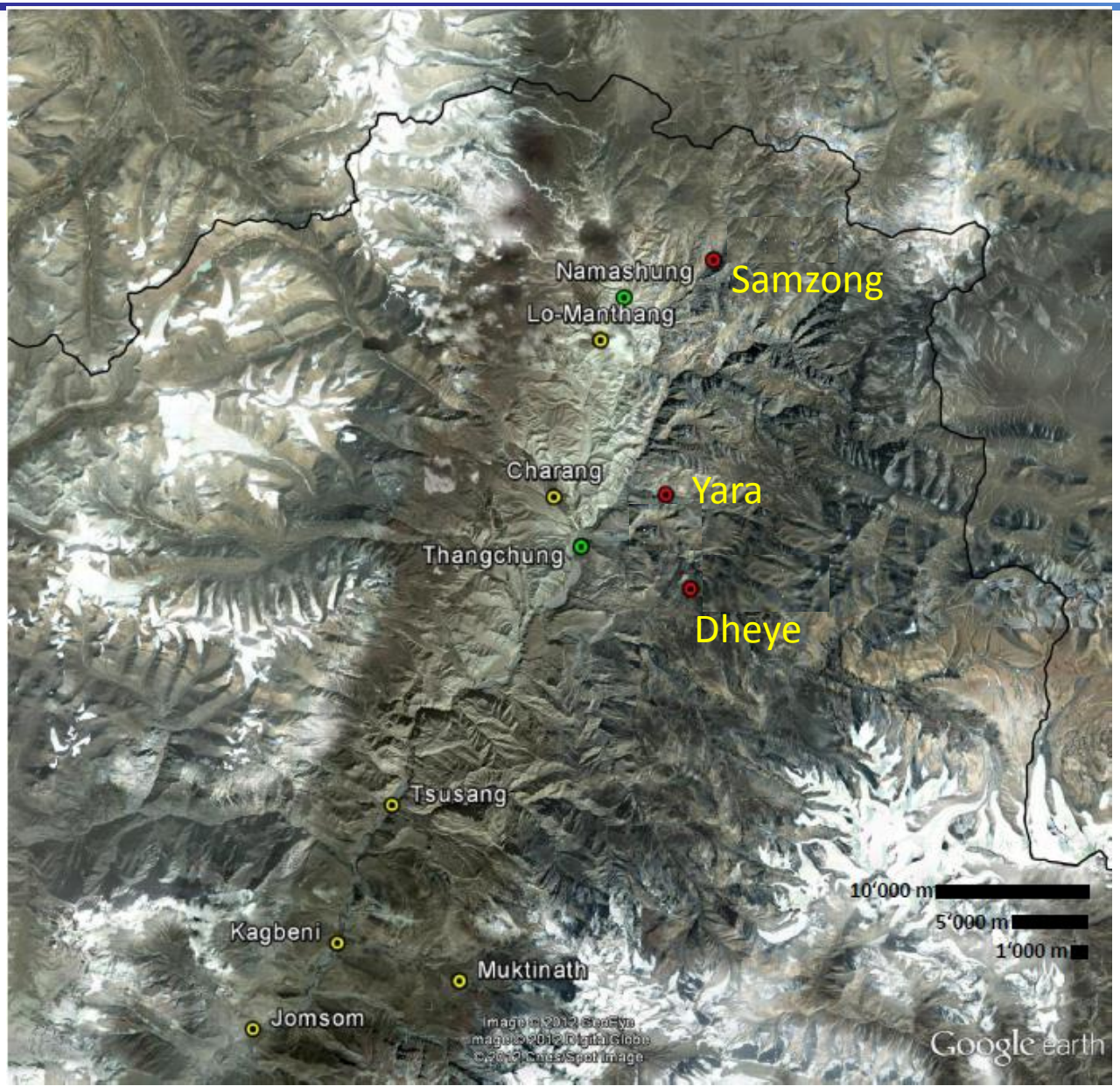
Zurick et al. (2006)

- Mustang is part of the **Trans-Himalaya**
- In the **north**, Mustang is bordering the Tibetan plateau of the People's Republic of China
- in **west:** the Nepalese Districts Dolpa,
- in the **south**: Myagdi
- in the **east:** Manang

District Mustang



Study area



- The villages are located in ***Upper Mustang***, which is a "restricted area".
- Upper Mustang is part of the ***Annapurna Conservation Area*** (ACA).
- **Altitude**:

village	m asl
Samzong	~ 4000
Yara	~ 3650
Dheye	~ 4000

- The villages lie in ***unglaciated catchments***.
- ***Samzong*** and ***Dheye*** are accessible ***on foot only***.
- ***Yara*** is accessible seasonally ***by tractor***.

Samzong

- **Overview** of Samzong seen from south

- **Foreground**: abandoned fields (in grey), separated from the settlement by the Samzong Khola
- **Background**: cliffs with ancient caves

Yara

- Yara seen from the left riverside of the Puyung Khola
- The village is located on the right riverside

Dheye

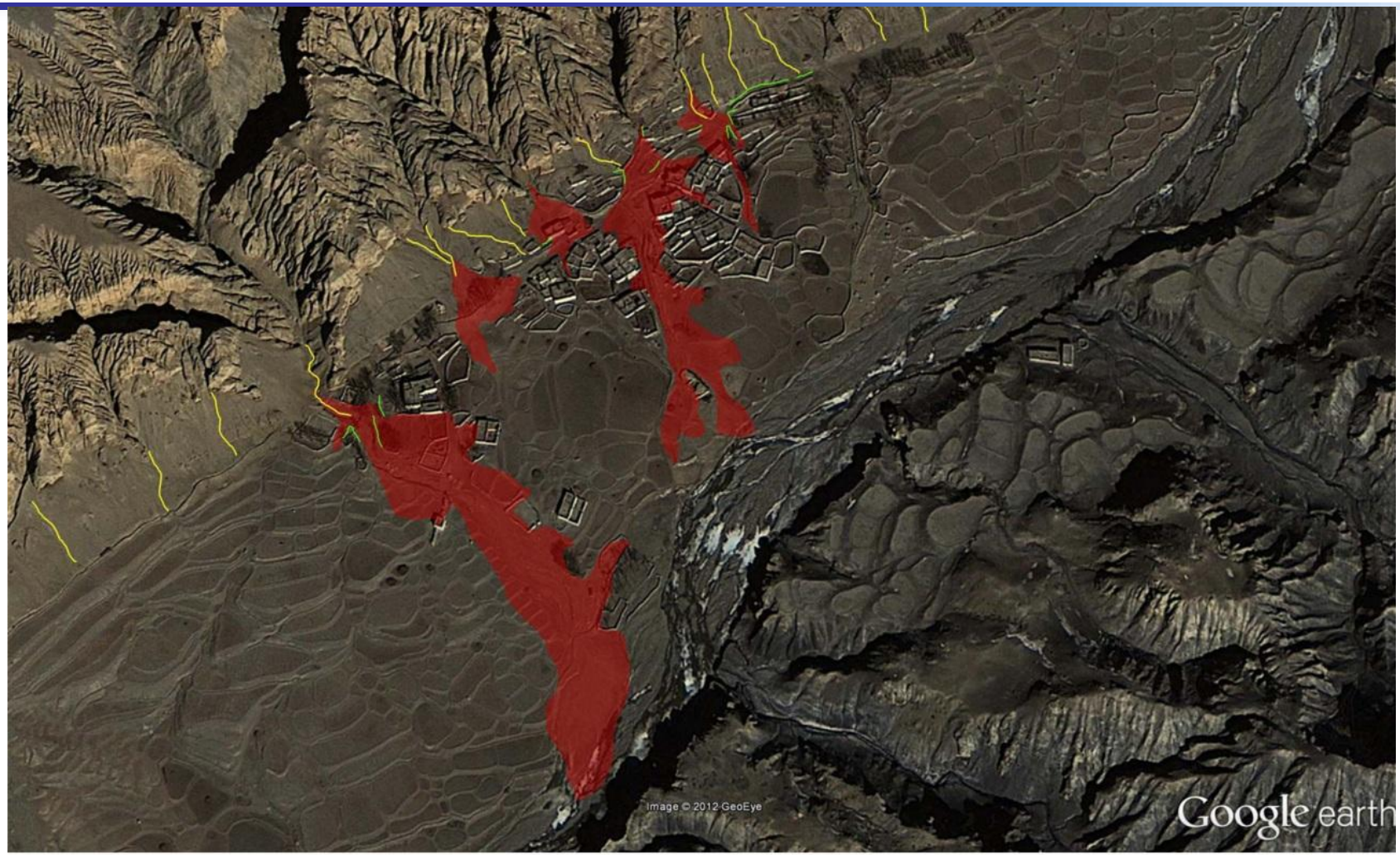
- Overview of Dheye seen from southwest

Background of the study

Existing problems

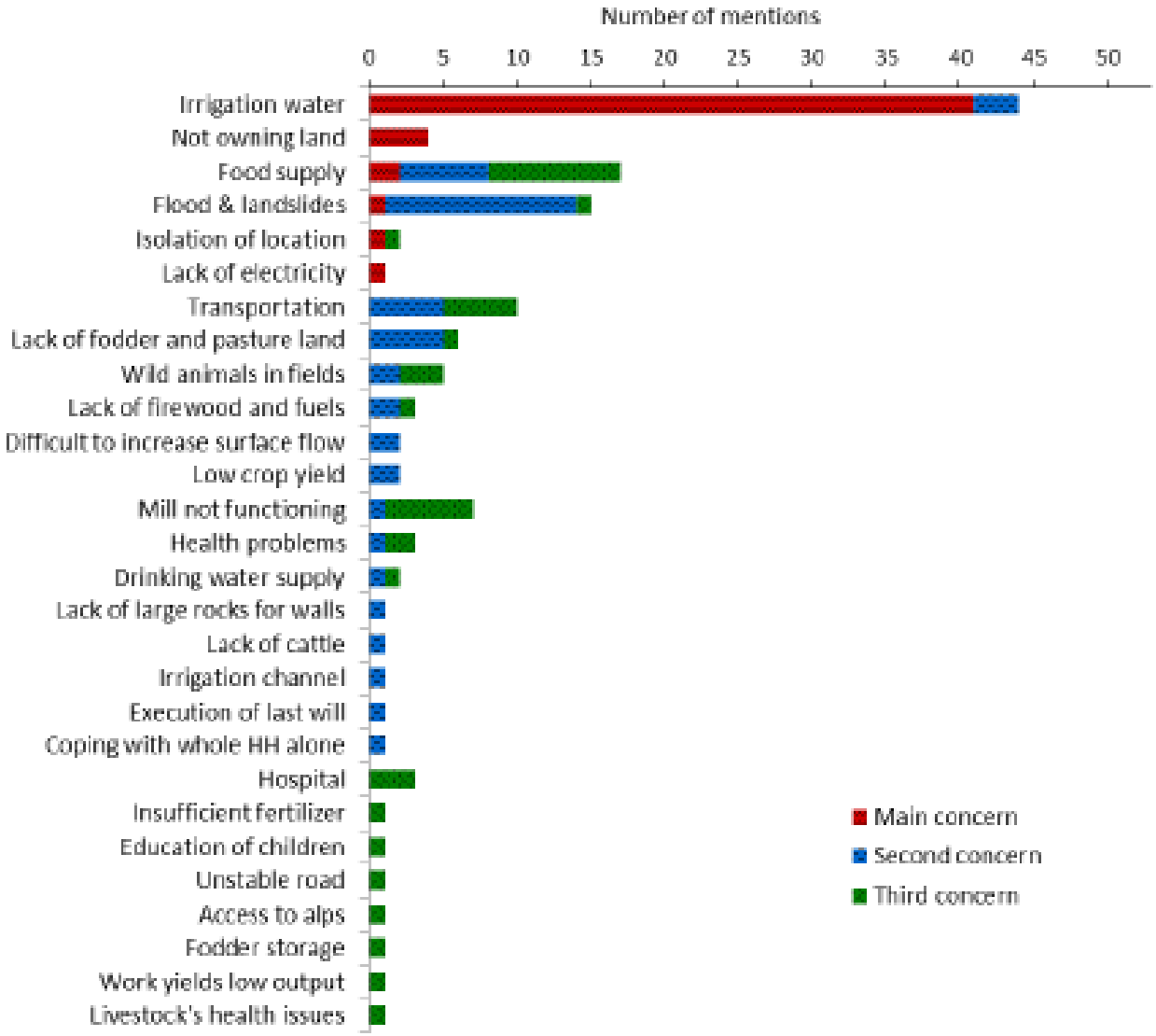
- The predominant problem in all three villages is the combination of ***insufficient water availability*** and ***inefficient irrigation supply systems***.
- Additionally, in ***Samzong***, the settlement, as well as the surrounding fields and irrigation channels are threatened by ***floods*** and ***landslides*** during the summer.
- ***Irrigation water*** is seriously ***lacking*** from April to June.
- The ***drinking water supply*** was found to be ***sufficient***.
- ***Agricultural activities*** are ***low productive*** and almost ***solely dependent on the perennial flow*** of the corresponding rivers.
- It is likely, that ***snow cover has became less*** during recent winters, generally producing ***less melt water*** in spring
- Each of the three villages lies within a ***catchment***, that is ***not glaciated***. This leads to a much heavier ***water stress*** compared to glaciated catchments with more favorable water regimes.

Background of the study



Hazard map of Samzong village

Background of the study



Main concerns

- ***Main problems*** faced by the community.
- ***53 households have been asked*** to identify their three main issues about which they are most concerned.
- With a ***striking majority***, the ***insufficient irrigation water*** was identified by the villagers as main problem.

Economic situation

- In all villages, economic activities are mostly limited to ***stockbreeding*** (goats, cows, yaks, horses) and ***subsistence agriculture***, strongly prejudiced by the scarce irrigation water.
- Stockbreeding is the main economic activity that allows generating some ***monetary income***.
- Monetary income is essential to assuring the subsistence, since the ***output from agriculture alone is not sufficient***.

SAMZONG

- subsistence agriculture
- stockbreeding
- collecting and selling herbs

YARA

- subsistence agriculture
- stockbreeding
- collecting and selling herbs
- providing touristic accommodations (guesthouse, campground)
- handcrafts
- tourist guides
- tractor transport service
- small shop

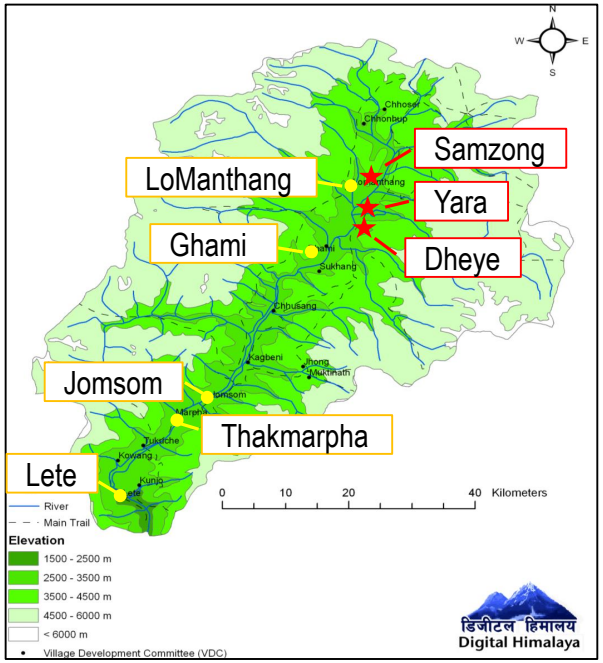
DHEYE

- subsistence agriculture
- stockbreeding
- collecting and selling herbs
- collecting and selling fossils

Of all three villages, ***Yara*** displays clearly the ***largest diversity of economic activities***.

Climatic Conditions

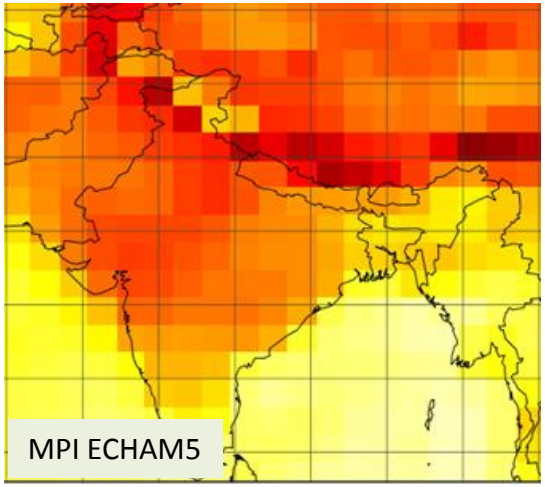
- ***Cold***, ***windy*** and ***dry*** climate ➡ almost ***desert like*** landscape
- Mean ***yearly precipitation*** sums in the northern part of Mustang: ***200 mm*** or less
- Precipitation takes place ***mainly during July to September***.
- Mustang lies in the ***rain shadow*** of ***Annapurna*** (8100 m asl) and ***Dhaulagiri*** (8170 m asl).

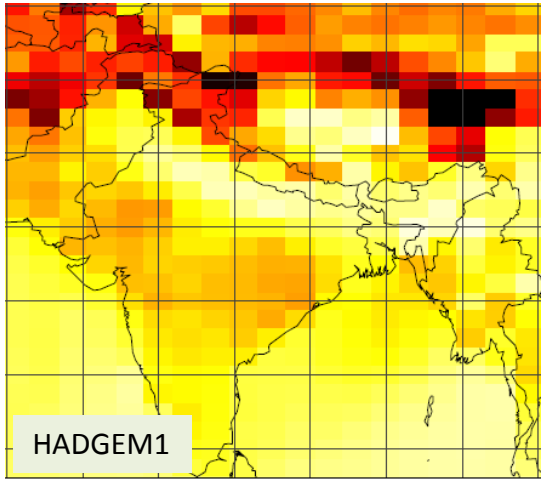


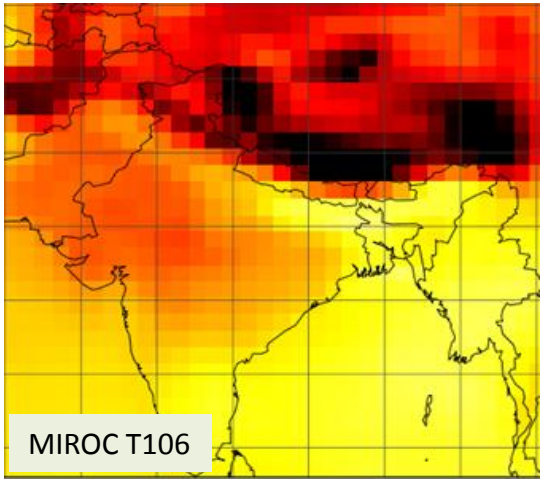
Station (1975-2005)	Altitude [m asl]	Monsoon mean JJAS [mm]	yearly mean [mm]
Lete	2384	798	1308
Thakmarpha	2566	228	402
Jomsom	2744	132	246
Ghami	3465	97	174
LoManthang	3705	93	144

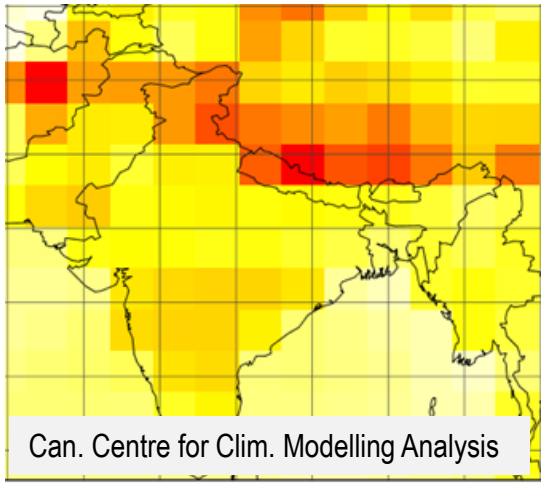
Climate Change

Air temperature anomalies in ***January*** for 2080-2099 based on ***scenario SRA1B***









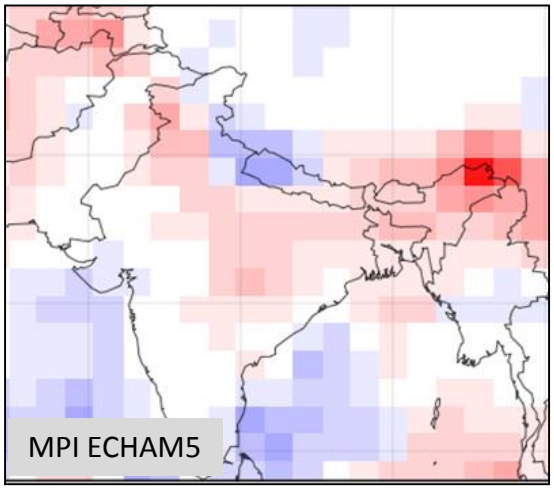
- ***Temperature development*** up to the end of the 21st century
- The anomalies were projected by different Global Circulation Models (***GCMs***).
- The emission scenario chosen is ***SRA1B*** (CMIP3), which is an ***intermediate*** one.

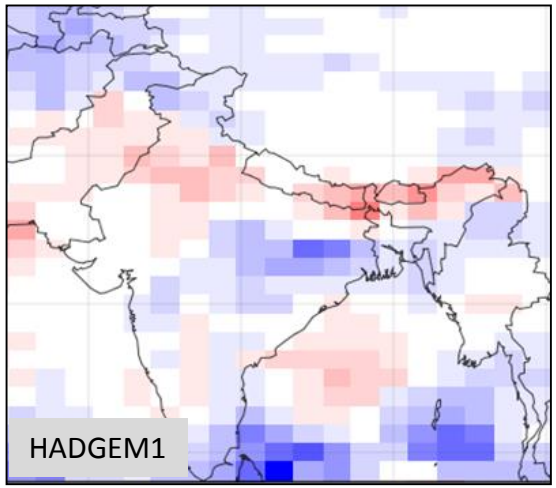
In ***Upper Mustang*** temperatures are expected to rise

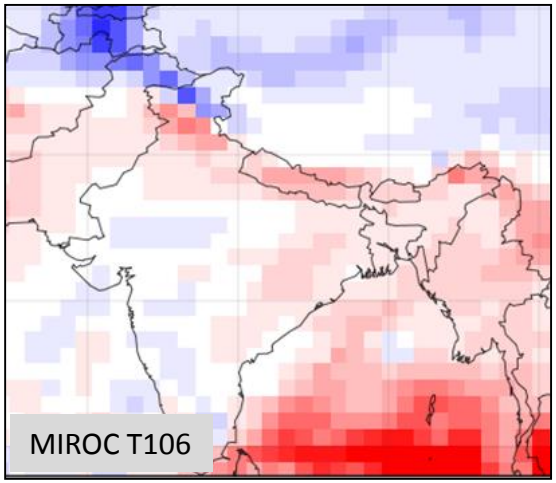
- **6-10** °C in **winter**
- **4-10** °C in **summer**

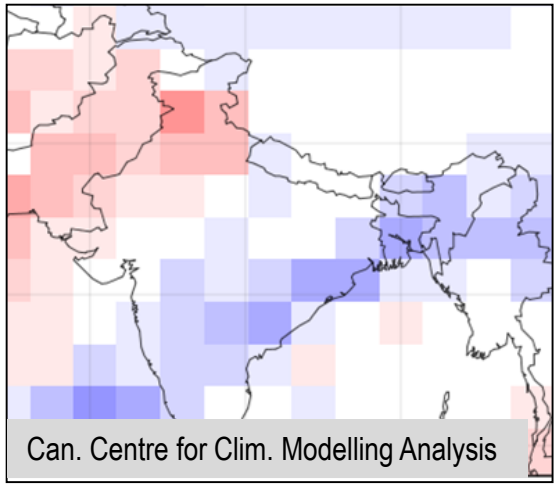
Climate Change

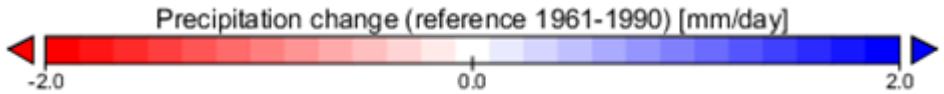
Precipitation anomalies in ***January*** by 2090 based on ***scenario SRA1B***











- The anomalies were projected by different Global Circulation Models (***GCMs***).
- The emission scenario chosen is ***SRA1B*** (CMIP3), which is an ***intermediate*** one.

In ***Upper Mustang***

In ***January***, the differences to the reference period (1961-1990) is expected to be small.

No dramatic changes in ***monsoon precipitation sums*** are expected.

Expected ***delay of the onset of monsoon***: ~ 5 to 10 days

Climate Change

Future changes in snow cover

- Even if the precipitation sums are not changing significantly in the future, the ***implications***, particularly related to the ***snow cover***, are ***severe***.

- Assuming a ***constant*** future ***precipitation*** amount, as well as ***increasing temperature*** and ***wind speed***, the snow cover is going to become less and less substantial, because of the following reasons:

  - Overall ***rising elevation of the snowline*** due to increased temperatures
  - ***Faster disappearing snow cover*** due to warmer weather conditions.
  - Possibly ***more dust deposition***, leading to ***decreased albedo*** and therefore a ***quicker melting process***

Qualitative assessment

Moving down or not?

- The main goal of this study was to identify the most appropriate and sustainable response to face the current challenges in terms of ***water availability*** as well as ***natural risks*** and associated ***socio-economic*** aspects.
- The ***current problems*** in the existing villages were ***holistically analyzed*** and possible solutions elaborated.
- ***20*** previously ***identified core issues*** were analysed.
- For each issue it was discussed, whether the situation is better at the current or the displaced location.

Qualitative assessment

Issues of the qualitative assessment of Samzong - I

No	Aspects	Issue	Stay	Neutral	Move
1	**Physical** character-istics	Irrigation water availability			x
2		Drinking water availability		x	
3		Drinking water quality	x		
4	**Irrigation** water supply system	Technical complexity		x	
5		Initial costs		x	
6		Overall durability (abrasion, exposure to natural hazards)		x	
7		Maintenance and operation (labour, associated costs, etc.)			x
8	**Drinking** water supply system	Technical complexity	x		
9		Initial costs	x		
10		Overall durability (abrasion, exposure to natural hazards)			x
11		Maintenance and operation (labour, associated costs, etc.)			x

Qualitative assessment

Issues of the qualitative assessment of Samzong - II

No	Aspects	Issue	Stay	Neutral	Move
12	**Geolo-gical** risks	Exposure of settlement to geol. risks			x
13		Exposure of agricult. area to geol. risks	x		
14	**Socio-economic** issues and **ambient** conditions	Access to public services (i.e. health)			x
15		Opportunities for economic activities		x	
16		Opportunities related to tourism			x
17		Demographic stability and evolution			x
18		Communal cohesion	x		
19		Access to natural and energetic resources			x
20		Ambient environmental conditions (wind, sunshine duration, thunderstorms, etc.)		x	

Conclusions

Moving down or not?

Resettle the whole community

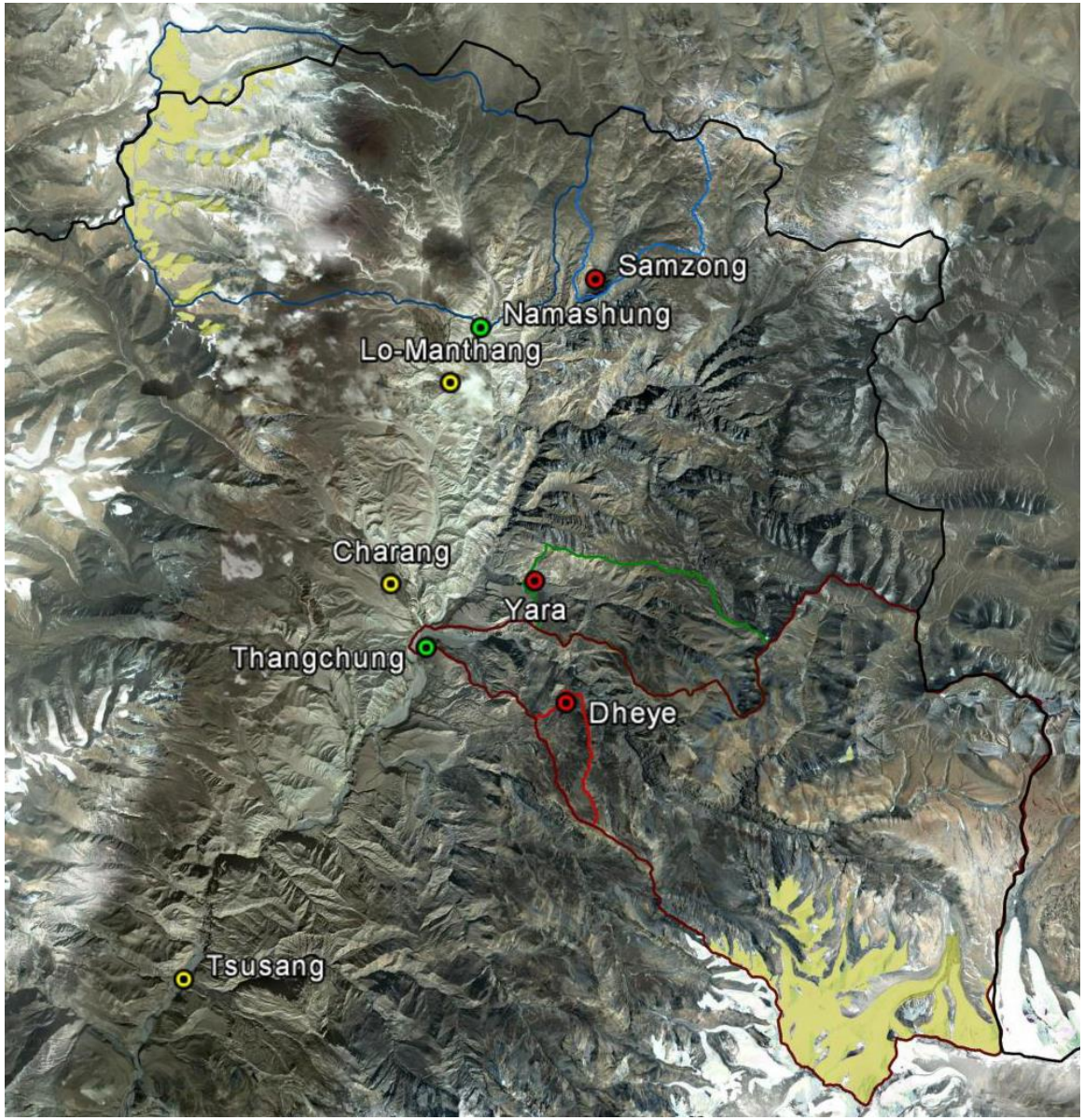
Samzong ➢ Namashung

Dheye ➢ Thangchung

Stay at the current location

Yara ➢ diversify economic activities in situ

Relocation sites



Relocation sites:

- Samzong ➡ Namashung
- Dheye ➡ Thangchung

Advantages:

- glaciated catchments, with more favorable water regimes
- much larger catchment area
- catchments span over a larger altitude range
- lower altitude and longer vegetation periods
- construction of orchards to generate monetary income
- possible activities exploiting touristic potential are far greater
- better access to public services of neighboring villages

Thanchung (Dheye)

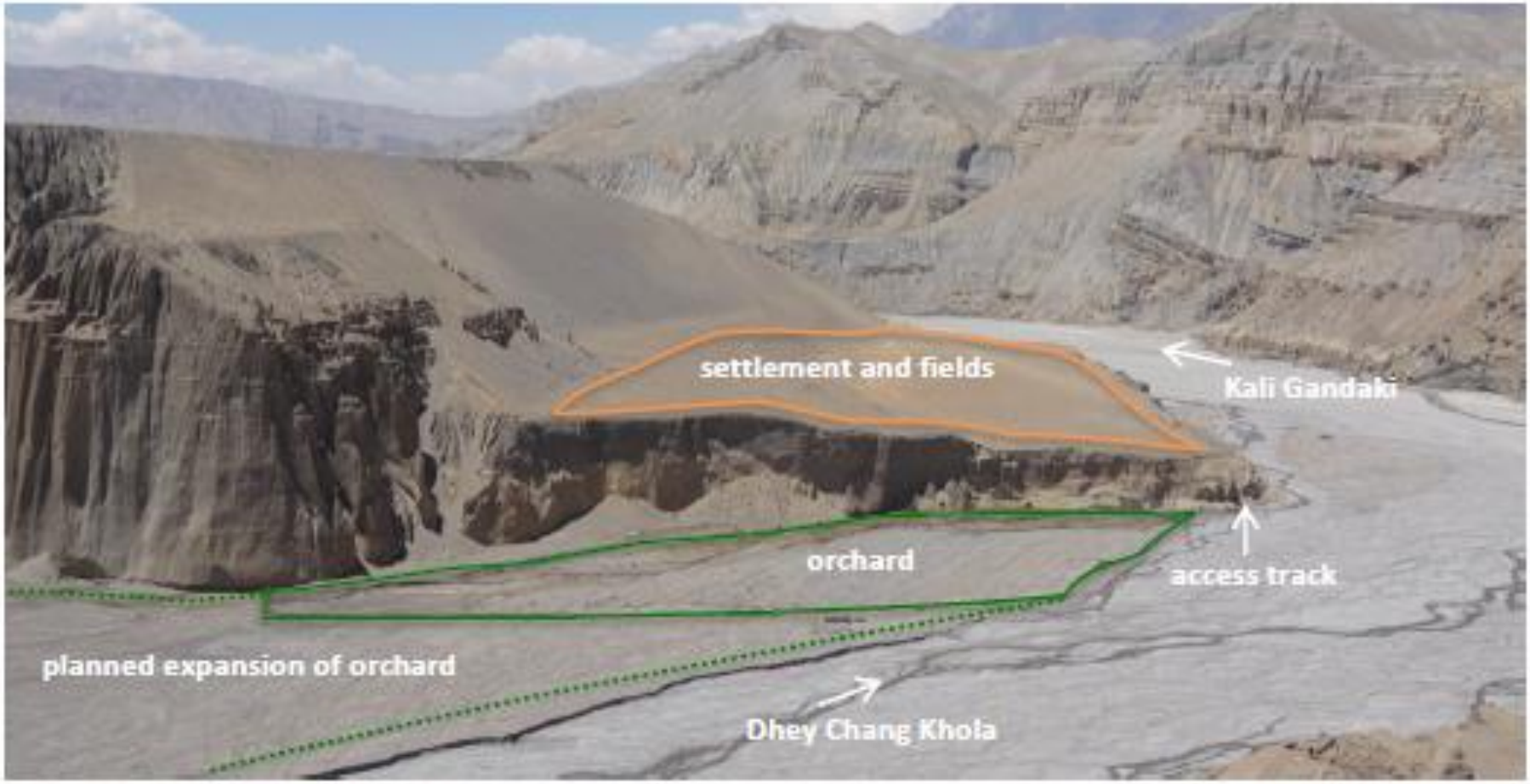


Figure 5.2: Thangchung seen from northeast. Below the designated relocation site (orange), an orchard has been realized (solid green), which is planned to be expanded extensively in the future (dotted green). A dirt track, recently realized, accessing the plateau is highlighted (photo: 13/05/2012, Daniel Bernet).

‘No-regret’ measures

Definition

- ‘No-regret’ measures are activities that yield ***benefits for all stakeholders under all future climate scenarios***.
- The impacts of ‘no-regret’ measures are ***consistently positive***.
- ‘No-regret’ measures are ***cost-effective***.
- Unfortunately, ‘no-regret’ measures are ***very rare***.

Is water harvesting really a ‘no-regret’ measure?

	T ⇧ P ⇧	T ⇩ P ⇧	T ⇩ P ⇩	T ⇧ P ⇩
Upstream Agronomy	++	+	+	+
Downstream Agronomy	+	+	–	–
Malaria	– –	–	+	–

Qualitative assessment

Issues of the qualitative assessment of Samzong

Stay	Neutral	Move
		X
	X	
X		
	X	
	X	
	X	
		X
X		
X		
		X
		X

Stay	Neutral	Move
		X
X		
		X
	X	
		X
		X
X		
		X
	X	

No	Aspects	Issue	Qualification		
			Stay	Neutral	Move
1	Physical character-istics	**Irrigation water availability**			✓
2		Drinking water availability		✓	
3		Drinking water quality	✓		
4	Irrigation water supply systems	Technical complexity		✓	
5		Initial costs		✓	
6		Overall durability (Abrasion, exposure to natural hazards)		✓	
7		Maintenance and operation (labor, associated costs etc.)			✓
8	Drinking water supply systems	Technical complexity	✓		
9		Initial costs	✓		
10		Overall durability (Abrasion, exposure to natural hazards)			✓
11		Maintenance and operation (labor, associated costs etc.)[a]			✓
12	Geological risks	**Exposure of the settlement to geological risks**			✓
13		Exposure of the agricultural area to geological risks	✓		
14	Socio-economic issues and ambient conditions	Access to public services (i.e. health and education)			✓
15		Opportunities for economic activities		✓	
16		Opportunities related to tourism			✓
17		Demographic stability and evolution			✓
18		Communal cohesion	✓		
19		Access to natural and energetic resources			✓
20		Ambient environmental conditions (wind, sunshine duration, thunderstorms, etc.)		✓	
Total count			5	6	9